

University of Nevada, Las Vegas
Department of Geoscience
GEOL 749 Advanced Geochronology and Thermochronology Spring 2018
Lecture 8:30-9:45 am Monday/Wednesday TEC 104

Instructor: Terry Spell LFG 206 office: 895-1171 email: terry.spell@unlv.edu
Office hours: 2:00-3:00 pm Monday/Wednesday, or by appointment

Geochronology can be defined as the science of determining the timing of formation of rocks, minerals, or the exposure age of rock surfaces. Thermochronology is concerned not simply with how long a rock body has been in existence, but rather with what its thermal history has been *after* it came to exist as a rock. In other words, geochronology is concerned simply with the age of a rock (or surface), whereas thermochronology deals with what has subsequently happened to a rock (e.g., timing and rate of cooling). A large number of analytical techniques have been developed, primarily during the last 50 years; most are based on accumulation of radiogenic or cosmogenic “daughter” nuclides at known rates over geologic time. There is no upper limit to many of our dating methods, and the younger limits are being pushed to the point that someone was around to verify the event historically. This course is designed to take you through the details of some of the most commonly used dating techniques in the geosciences. We will cover the vagaries of determining eruption ages of volcanic rocks (the simplest geologic history, but not always simple to date), the more complicated issues of determining thermal histories of rocks, and finally some of the details of surface (cosmogenic) exposure dating.

Grades will be based on a combination of scores from tests, laboratory work/problem sets, and the production and presentation of a research paper. Tests will include two regular exams and a final. These will consist of short answer and essay questions; tests count as outlined below, and the final exam will be comprehensive. Research papers should be less than 10 pages in length (including tables and figures) and approximately 15 minutes will be allotted for presentations, GSA style. Grades will be calculated as follows:

Test 1 = 25%
Test 2 = 25 %
Final = 30%
Paper/Presentation = 20%

The following schedule outlines what we will cover in this course. Readings will be assigned from various sources. If, after reading the material and attending class, you do not understand concepts feel free to speak to me after class, by phone or e-mail, or during office hours.

GEOL 749 Advanced Geochronology and Thermochemistry
Course Outline - Spring 2018

<u>Week of:</u>	<u>Subject</u>
January 15	Introduction to course (no class Monday, MLK holiday)
January 22	Nuclear systematics, radioactive decay, mass spectrometry - basic concepts
January 29	Mass spectrometry, Introduction - K/Ar and $^{40}\text{Ar}/^{39}\text{Ar}$ dating methods
February 5	The $^{40}\text{Ar}/^{39}\text{Ar}$ dating method, $^{40}\text{Ar}/^{39}\text{Ar}$ dating of volcanic rocks
February 12	$^{40}\text{Ar}/^{39}\text{Ar}$ dating of volcanic rocks
February 19	$^{40}\text{Ar}/^{39}\text{Ar}$ dating of volcanic rocks, <u>Test #1</u>
February 26	Cosmogenic surface exposure dating methods; ^3He and ^{21}Ne
March 5	Cosmogenic surface exposure dating methods; ^3He and ^{21}Ne
March 12	Volume diffusion and the closure temperature T_c concept
March 19	Fission-track dating, The U/Pb zircon dating method
March 26	Spring Break Week – no classes
April 2	The ion microprobe U/Pb dating technique, <u>Test #2</u>
April 9	$^{40}\text{Ar}/^{39}\text{Ar}$ thermochronology - K-feldspar $^{40}\text{Ar}/^{39}\text{Ar}$ modeling
April 16	$^{40}\text{Ar}/^{39}\text{Ar}$ thermochronology, U/Th-He dating
April 23	Thermal history reconstructions/interpretations
April 30	Thermal history reconstructions/interpretations, Present research papers
May 7	Final Examination Week – GEOL 749 Wednesday May 9, 8:00-10:00 am

UNLV Course Syllabus Information

GEOL 749 – Advanced Geochronology and Thermochronology (3 credits)

8:30-9:45 AM, Monday/Wednesday

Instructor – Dr. Terry Spell, LFG 206, 895-1171 office phone

Course Learning / Outcome Objectives

Upon completion of this course students should have knowledge of:

1. Basic principles of isotopic dating as applied in the geologic sciences.
2. Thermochronologic implications of isotopic dates for rock histories.
3. Details of the U/Pb dating system.
4. Details of the $^{40}\text{Ar}/^{39}\text{Ar}$ dating system.
5. Details of the cosmogenic dating systems.
6. Application/combination of multiple isotopic systems to determine thermal histories.
7. General knowledge of, and problems with, cosmogenic surface exposure dating.

Assessment - These learning/outcome objectives and grades will be evaluated based on lecture exams, a research paper, and a comprehensive final exam.

Purpose of this course - The course provides a comprehensive understanding of the science of geochronology and thermochronology. The course satisfies the UNLV graduate credit requirements. Students are responsible for attending class, maintaining notes, attending laboratory sessions, and reading assigned materials. Examinations will be short answer and essay style for lecture material. Departmental policy precludes makeup exams, however, with prior notification and approval exams may be taken early.

Academic Misconduct – Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling in UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution.

An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the *Student Academic Misconduct Policy* (approved December 9, 2005) located at:

<http://studentconduct.unlv.edu/misconduct/policy.html>.

Copyright – The University requires all members of the University Community to familiarize themselves and to follow copyright and fair use requirements. **You are individually and solely responsible for violations of copyright and fair use laws. The university will neither protect nor defend you nor assume any responsibility for employee or student violations of fair use laws.** Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. Additional information can be found at:

<http://www.unlv.edu/provost/copyright>.

Disability Resource Center (DRC) – The UNLV Disability Resource Center (SSC-A 143, <http://drc.unlv.edu/>, 702-895-0866) provides resources for students with disabilities. If you feel that you have a disability, please make an appointment with a Disabilities Specialist at the DRC to discuss what options may be available to you.

If you are registered with the UNLV Disability Resource Center, bring your Academic Accommodation Plan from the DRC to me during office hours so that we may work together to develop strategies for implementing the accommodations to meet both your needs and the requirements of the course. Any information you provide is private and will be treated as such. To maintain the confidentiality of your request, please do not approach me before or after class to discuss your accommodation needs.

Administrative Drops/Classroom Conduct

You are required to be familiar with university policies and procedures in the current UNLV Catalog. Importantly, we follow the policies on Administrative Drops/Classroom Conduct as stated in the most recent UNLV Undergraduate Catalog. Any student that does not comply with these requirements, and conducts themselves in a manner that is disruptive and interferes with the right of other students to learn or of the instructor to teach will be administratively dropped from the course.

Learning Environment

The classroom is intended to be a place of learning. As such, and as specified in the UNLV Undergraduate Catalog, no pagers, cell phones, or other potentially disruptive devices are allowed in either lecture or laboratory. Student usage of laptop computers, recording equipment, or similar devices is only allowed with explicit permission of the instructor, and is restricted to taking notes for this course. Disruptive behavior including, but not limited to those described above, chatting, sleeping, watching video, playing games or texting may result in an administrative withdrawal from the course.

Bringing children to class

Students are not allowed to bring guests, including children to lecture, unless there is prior approval from the instructor.

Religious Holidays Policy – Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor no later than the end of the first two weeks of classes, **January 31**, of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. This policy shall not apply in the event that administering the test or examination at an alternate time would impose an undue hardship on the instructor or the university that could not have reasonably been avoided. For additional information, please visit: <http://catalog.unlv.edu/content.php?catoid=4&navoid=164>.

Incomplete Grades - The grade of I – Incomplete – can be granted when a student has satisfactorily completed all course work up to the withdrawal date of that semester/session but for reason(s) beyond the student's control, and acceptable to the instructor, cannot complete the last part of the course, and the instructor believes that the student can finish the course without repeating it. A student who receives an I is responsible for making up whatever work was lacking at the end of the semester. If course requirements are not completed within the time indicated, a grade of F will be recorded and the GPA will be adjusted accordingly. Students who are fulfilling an Incomplete do not register for the course but make individual arrangements with the instructor who assigned the I grade.

Tutoring – The Academic Success Center (ASC) provides tutoring and academic assistance for all UNLV students taking UNLV courses. Students are encouraged to stop by the ASC to learn more about subjects offered, tutoring times and other academic resources. The ASC is located across from the Student Services Complex (SSC). Students may learn more about tutoring services by calling (702) 895-3177 or visiting the tutoring web site at: <http://academicsuccess.unlv.edu/tutoring/>.

UNLV Writing Center – One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 895-3908. The student's Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: <http://writingcenter.unlv.edu/>

Rebelmail – By policy, faculty and staff should e-mail students' Rebelmail accounts only. Rebelmail is UNLV's official e-mail system for students. It is one of the primary ways students receive official university communication such as information about deadlines, major campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the university. Students' e-mail prefixes are listed on class rosters. The suffix is always @unlv.nevada.edu.